OBSERVED CHANGES IN WEATHER TYPES OVER SPAIN

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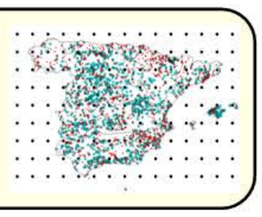
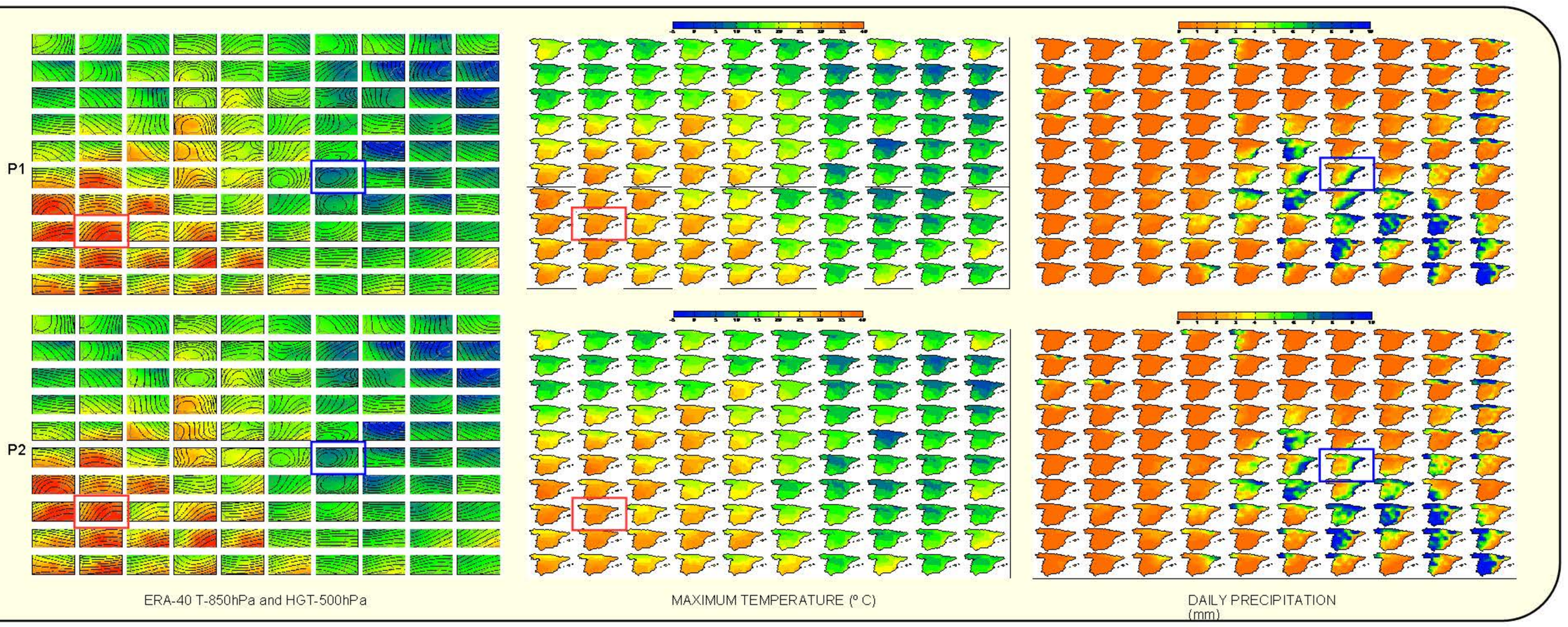
DAILY DATA

- 888 barometric stations
- 1325 pluviometric stations
- 1º resolution ERA-40 nodes

Period 1 (**P1**): 1957-1979
Period 2 (**P2**): 1980-2002

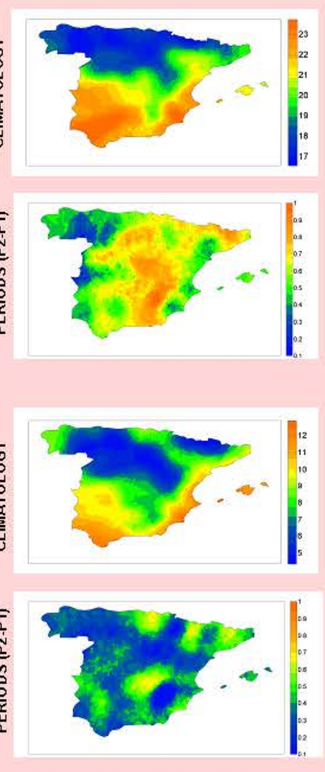


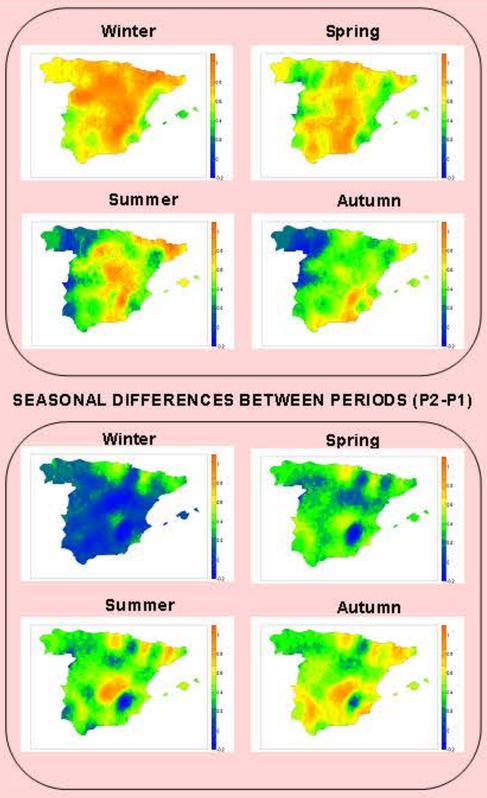
Abstract: It is known that the observed variability of meteorological phenomena, at daily timescales, is due to changes in the atmospheric state and, therefore, alterations in the observed phenomenology are just an effect of changes in the atmospheric variability. In this work we have compared daily surface observations of extreme temperatures and precipitation (from the AEMet's network), in two different periods of time (1957-1979 and 1980-2002) in mainland Spain and the Balearic Islands, so as to identify and analyze changes in the daily atmospheric variability. In order to carry this out, a joint probabilistic analysis of Weather Types (WTs) and meteorological phenomena has been made. The results show that there are significant differences, between the two periods of study, for both, surface observations and WTs' behavior.



EXTREME TEMPERATURES

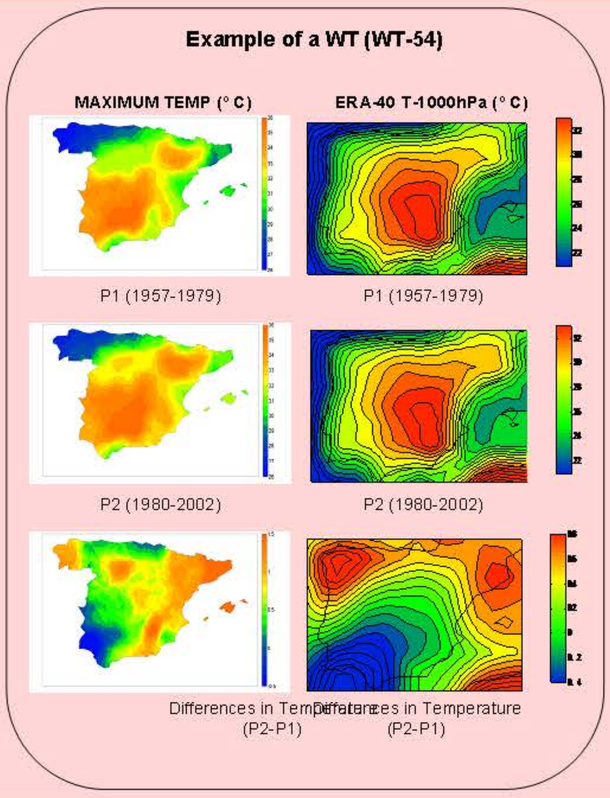
MAXIMUM TEMPERATURE (º C)



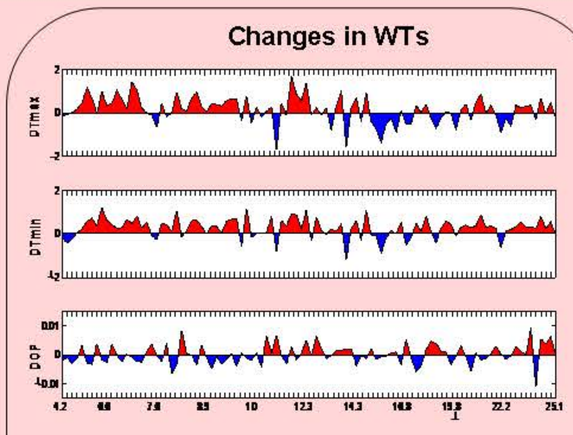


MINIMUM TEMPERATURE (º C)

Example of a WT (WT-54)



Changes in WTs



WTs ordered by their mean temperature (º C) during P1

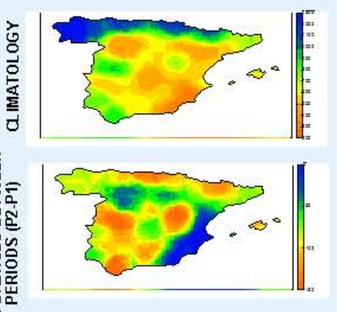
DTmax: Difference in Maximum Temperature (P2-P1) for each WT
DTmin: Difference in Minimum Temperature (P2-P1) for each WT
DPO: Differences in the occurrence probability of each WT

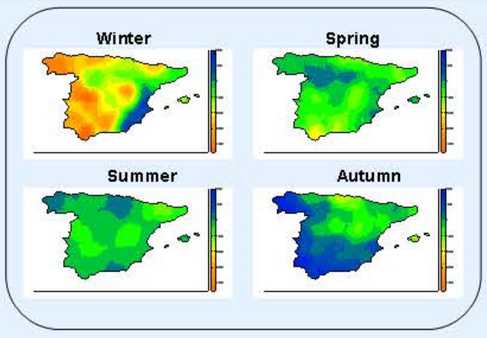
CONCLUSIONS

- Changes in extreme temperatures are heterogeneus in space, time, distribution of WTs, distribution of events, etc.
- The thermic amplitude in winter was higher during P2 than during P1.
- Almost all the WTs rose their extreme temperatures.
- The warmest WTs were more frequent during P2.
- Both extreme temperatures rose since 1980.

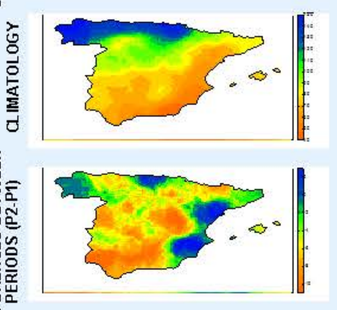
PRECIPITATION

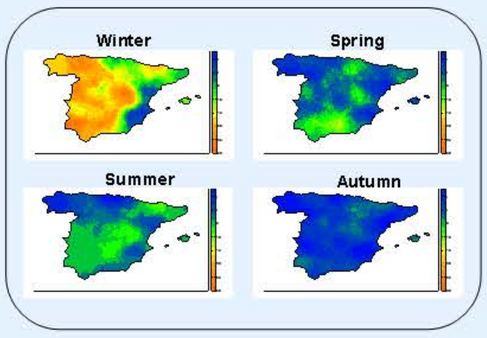
ACCUMULATED ANNUAL PRECIPITATION (mm)



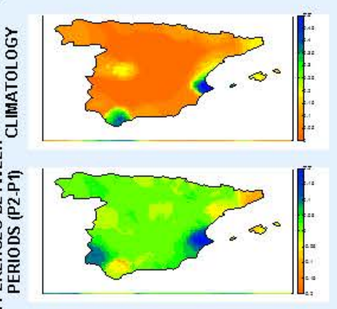


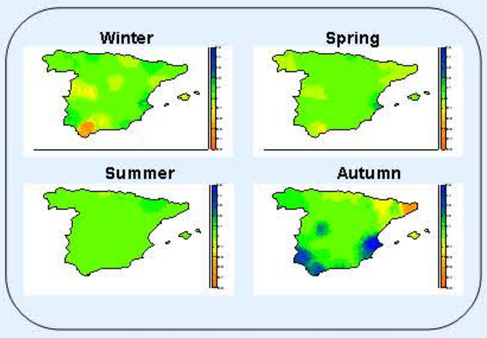
NUMBER OF DAYS WITH p>0 mm (days/year)





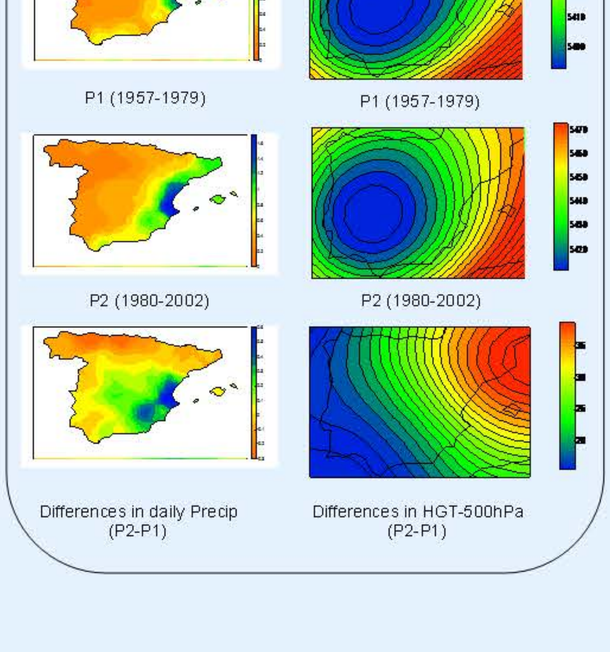
NUMBER OF DAYS WITH p>100 mm (days/year)



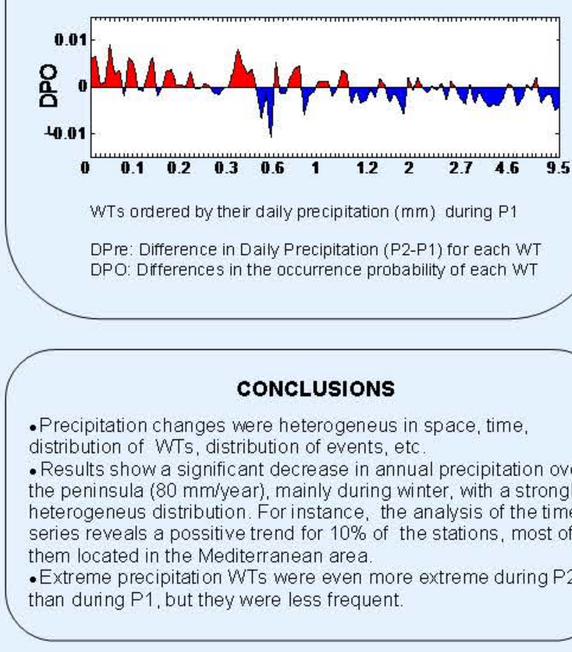


SEASONAL DIFFERENCES BETWEEN PERIODS (P2-P1)

Example of a WT (WT-99)



Changes in WTs



WTs ordered by their daily precipitation (mm) during P1

DPre: Difference in Daily Precipitation (P2-P1) for each WT
DPO: Differences in the occurrence probability of each WT

CONCLUSIONS

- Precipitation changes were heterogeneus in space, time, distribution of WTs, distribution of events, etc.
- Results show a significant decrease in annual precipitation over the peninsula (80 mm/year), mainly during winter, with a strongly heterogeneus distribution. For instance, the analysis of the time series reveals a possitive trend for 10% of the stations, most of them located in the Mediterranean area.
- Extreme precipitation WTs were even more extreme during P2 than during P1, but they were less frequent.

- Ancell R and Gutiérrez JM (2007): High resolution simulation of weather sequences for binary events with Generative Classifers. 10*th International Meeting on Statistical Climatology (IMSC)*, Proceedings of 10th IMSC:85.
- Bermejo M. and Ancell R. (2009): Statistical analysis of weather types over the Iberian peninsula domain. *Clima en España: Pasado, presente y futuro. Contribución a un Informe de Evaluación del Cambio Climático Regional, Feb 2009, Madrid* http://www.mdm.unican.es/files/posters/2009_Bermejo_CLIVAR_talk.pdf
- Bermejo M. and Ancell R. (under revision): Observed changes in extreme temperatures over Spain during 1957-2002, using Weather Types. *Revista de Climatología*.